thermal treatment after forming the piezoelectric/electrostrictive film element, whence it is preferable to dry the piezoelectric/electrostrictive film element at 70-100°C.

The piezoelectric/electrostrictive film element obtained by the method is excellent in characteristics proper of ceramics though the element has been thermally treated at low temperature.

So as for the present invention as above, energy required for electrophoretic deposition process is reduced because the ultrafine ceramic oxide powder is used and there is a low energization effect of the producing method because the piezoelectric/electrostrictive film element can be formed where the stacking status of the particles is very dense even only with the thermal treatment at low temperature.

Now the present invention will be explained in detail by the following practical examples. But the following application examples are only illustrations of the present invention and do not confine the extent of the present invention.

[Example 1]

1 g of fine powder PZT-PMN was added into methoxyethanol 300 ml and acetyl acetone 20 ml, and 1 g of PZT sol was added into the mixed solution,. Then it was dispersed for 30 minutes by a ultrasonic generator. Afterwards it was agitated by a magnetic stirrer.

A SUS 316L plate fixed of silicon substrate and mask was prepared as a work electrode and a SUS plate of same area was prepared as an opposite charge electrode. The electrodes were put into the suspension and were connected to electric supply to

proceed electrophoretic deposition at 70 V and 0.03 A for 10 minutes.

The work electrode completed of vapor deposition was withdrawn, the substrate was separated from the SUS plate, and the mask was removed.

The substrate where a pattern had been formed was thermally treated at 100°C in a chamber and was dried, which was then thermally treated at 300°C, 2 hr. Then aluminum was vapor deposited as an upper electrode, and electric potential was added to measure the displacement of the substrate (vibration plate) by piezoelectric phenomenon.

The piezoelectric characteristics represented by the displacement of the vibration plate was more excellent than that of a piezoelectric/electrostrictive film element produced by the conventional method.

[Example 2]

1 g of fine powder PZT-PMN was added into methoxyethanol 300 ml and acetyl acetone 100 ml, and into which mixed solution, 4 g of PZT sol was added. Then it was dispersed for 30 minutes by a untrasonic generator. Afterwards it was agitated by a magnetic stirrer.

A SUS 316L plate fixed of nickel substrate and mask was prepared as a work electrode and a SUS plate of same area was prepared as an opposite charge electrode. Then the electrodes were put into the suspension and were connected to electric supply to proceed electrophoretic deposition at 70 V and 0.03 A for 10 minutes.

The work electrode completed of vapor deposition was

withdrawn, the substrate was separated from SUS plate, and the mask was removed.

A substrate where pattern had been formed was thermally treated at 70°C in a chamber and was dried, which was then thermally treated at 300°C, 2 hr. Then gold was vapor deposited as an upper electrode, and electric potential was added to measure the displacement of the substrate (vibration plate) by piezoelectric phenomenon.

Piezoelectric characteristics represented by the displacement of the vibration plate was more excellent than that of a piezoelectric/electrostrictive film element produced by the conventional method.